tributed in its effects with an approach to uniformity over a wide extent of country, and was unaccompanied by those sharp flexings or the protrusions of abrupt granitic cores which are encountered in some portions of the Appalachians and other mountain regions. The individual masses and ranges in the Cumberland region are the work of erosion acting upon a broad platform, excavating wide valleys and narrow gorges, leaving the peaks and ridges as cameos and mere remnants of the general degradation of the entire region. Professor Powell exemplified the process by citing the Uinta Mountains as a broad platform similarly carved by an enormous erosion.

Mr. Lester F. Ward then read a communication entitled, "Field and Closet Notes on the Flora of the District of Columbia." Mr. Ward's paper was more comprehensive than its title indicated. He read extracts from a local monograph which he has been preparing on the Flora of the District of Columbia. The work has been done by Mr. Ward in his usual energetic, thorough, and philosophical manner, and presents many points of interest. It will be published in full by the Society.

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

The Society met in the lecture room of the National Medical College on Tuesday evening, February 1, Major J. W. Powell in the chair. By the provisions of the Constitution the retiring President is required to deliver his annual address at the meeting succeeding that held for the election of officers, and to review therein the work of the Society during the past year. As before mentioned, the reasons for the publication of elaborate proceedings, existing in the case of other societies, do not obtain here. The President, therefore, in connection with his address, had prepared a pamphlet of 100 pages, in which were embodied abstracts of every paper read during the two years of the Society's existence, together with a brief history of its formation, the two annual addresses, the constitution, and the list of officers and members. The whole constitutes a very important contribution to knowledge.

Major Powell thus presented a classification of the papers and discussed the several subjects treated in their order, namely: Archæology, ethnography, linguistics, biology, philosophy, technology, sociology, and mythology. As the address will appear in full as a part of the pamphlet, it is not necessary to present an abstract.

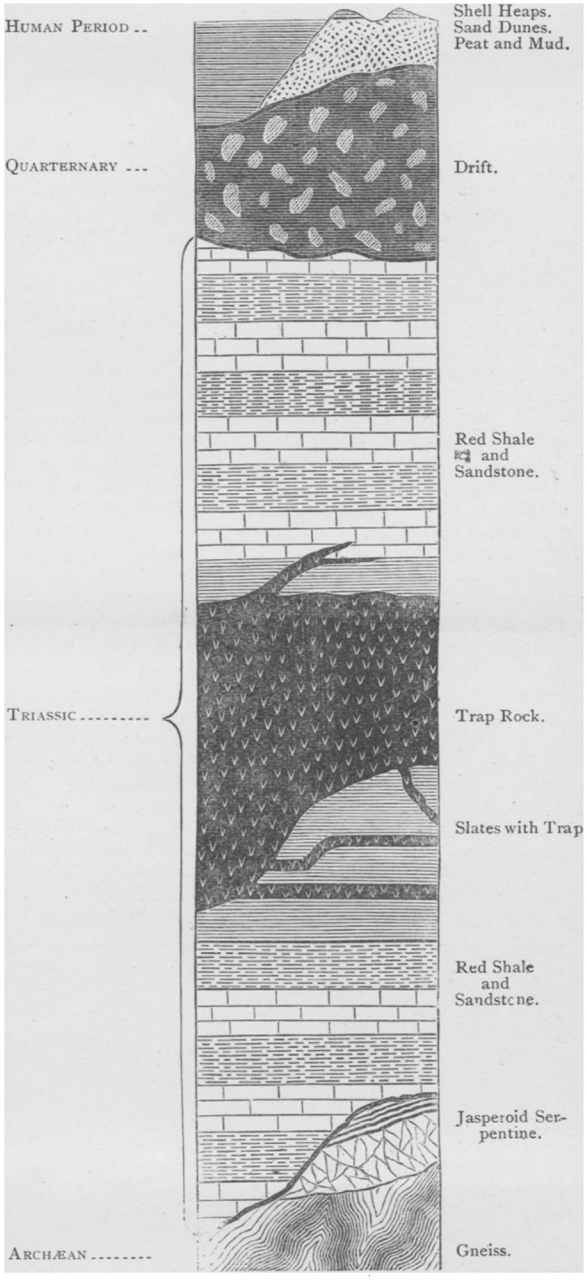
DETERMINATION OF GOLD AND SILVER IN ALLOYS, AFTER QUARTATION WITH CADMIUM.—Two portions of the alloy, each of 0.25 grms., are weighed off and placed with the cadmium in small porcelain vessels. A piece of potassium cyanide is melted in a porcelain capsule over the flame, and the metal thrown in. The melting together takes place readily, and is complete in a few minutes. By changing with two or three porcelain capsules, and having a vessel with warm water at hand, in which the melted portion is dissolved when sufficiently cool, twenty to thirty meltings can be executed in an hour. The two metallic granules are now thrown together into a small long-necked flask, in which is nitric acid of sp. gr. 1.30; a piece of wood charcoal is introduced to prevent bumping—which would rupture the globules—and heat is gently applied. The first solution lasts rather long, according to the proportion of gold; *e.g.*, an hour in case of fine gold. The solution is poured off, the boiling repeated with nitric acid of sp. gr. 1.3 for ten minutes, the liquid again poured off, the globules rinsed with hot water, boiled for five minutes with water, which is poured off, and the flask filled with water is inverted into a porous earthern crucible, dried, ignited strongly, proceeding as in cupellation. In most cases the globules can be weighed separately. Silver is determined in the solution of titration with ammonium sulphocyanide according to Volhard's method.—FR. KRAUS.

A SKETCH OF THE GEOLOGY OF HUDSON COUNTY, N. J.*

BY ISRAEL C. RUSSELL.

An outline of the geology of Hudson County, N. J., is delineated in the accompanying generalized section.

FIG. 1—GENERALIZED SECTION OF THE ROCKS OF HUDSON COUNTY, N. J.



At the base of the series is crystalline gneiss of Archæan age, which is exposed in a few reefs along the shore of the Hudson in Jersey City. These rocks are composed mainly of quartz, feldspar and mica, and form highly crystalline gneiss, mica schist, hornblende schist, etc., and are not to be distinguished from the rocks of

* Taken from a paper published in the Annals of the N. J. Academy of Sciences, Vol. II., No. 2, pp. 27-80.

the same formation exposed so abundantly on Manhattan Island.

Associated with the crystalline Archæan rocks that to a limited extent border Hudson County on the east, are beds of quartzite and serpentine, exposed in the bluff known as Castle Point at Hoboken. This premontory is about thirty acres in area, and is limited on the east by bold bluffs of serpentine. The rock here exhibits considerable variety, being sometimes yellowish and dull in appearance, and so earthy as to crumble between the fingers; again it is compact, dark green in color, and furnishes an ornamental, although interior, building stone. This rock is a silicate of magnesia containing chrome-iron in scattered grains, and furnishes also the minerals *marmolite, brucite, nemalite* and *magnesite.*

The quartzite or jasperoid rock, occurring on the southern slope of the serpentine, in the neighborhood of the Stevens Institute, has, together with the serpentine, been referred to the Archæan series, but as the exposures are now obliterated little can be said concerning it.

TRIASSIC ROCKS.

In Hudson county we have a portion of the eastern border of the Triassic formation which forms a band thirty miles broad across the State. In general with the Triassic formation in New Jersey and the Connecticut Valley, the rocks are here felspathic sandstones, slates and shales traversed by sheets and dikes of trap. The sedimentary rocks occupy nearly the whole area of the county and dip uniformly to the northwest at an angle of about 15°. The sandstone is largely composed of granules or fragments of felspar, cemented by oxide of iron to which the reddish or brownish color of the rock is due; this is the stone so largely used for architectual purposes in New York and the neighboring cities. Traversing these inclined beds of sedimentary rocks, and in a general way conformable with them, are sheets of intrusive trap, which now owing to unequal erosion, form the most prominent features in the topography of the county. This statement holds good, also, for the entire Triassic area in New Jersey, and with more or less accuracy for this formation in general along the Atlantic slope. The main trap ridge in Hudson County, composing the highland known in different portions of its course as Bergen Hill, Jersey City Heights, and the Heights of Weehawken, is continued northward with increasing height, and forms the bold picturesque shore of the Hudson as far northward as Haverstraw. The outcropping edge of the trap, especially in Hudson County, has been abraded by glacial action so as to form an irregular, badly drained, plane surface. Although in a general way following the bedding of the associated slates and sandstone, the trap sheet is really unconformable to them and breaks across their bedding in various places. From both the upper and lower surfaces of the main trap sheet smaller sheets and dikes of molten rock have been intruded among the stratified beds. Examples of these branches from the principal mass may be seen at the base of the cliffs along the west bank of the Hudson, from Hoboken northward. Secondary sheets originating from the upper surface also appear on the western border of Bergen Hill, where they have been accented by erosion. The intrusive nature of the trap sheets and dikes is shown by their crystalline structure, their unconformity to the inclosing stratified beds, and by the metamorphism produced in the strata with which they have come in contact. A section exposed in the cliffs bordering the Hudson a few miles north of Hoboken, is given in the following figure, and illustrates especially the abrupt manner in which the New Jersey Triassic area is cut off along its eastern border.

In the diagram D represents the sheet of drift that covers the eroded surface of the hill, and S the slates that unconformably underlie the trap into which a small

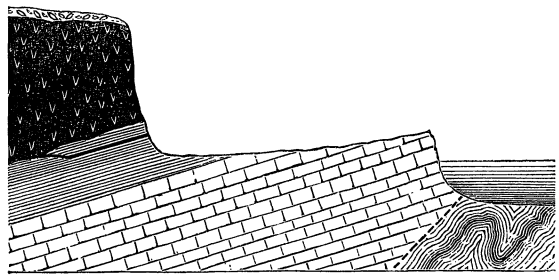


FIG. 2—SECTION AT DOG'S POINT, WEEHAWKEN.

secondary sheet of the crystalline rock has been intruded. Beneath the slates are beds of light colored felspathic sandstone ending in a cliff at the water's edge; the whole series has the usual dip of 15° N. W.

The irregular line formed by the eastern boundary of the trap is caused, at least in two instances, by sheets of trap that leave the main mass at an angle and stand out in ridges tangent to the principal line of cliffs; examples of this feature, which is difficult of description without illustrations, may be seen at Kings Point, Wehawken and Fairmont Hill, Jersey City.

POST-TRIASSIC HISTORY.

No records are found in Hudson County, of the Jurassic cretaceous or Tertiary periods during all these geological ages; the area under discussion must have been a land surface exposed to subaerial denudation. The same destructive agencies were at work, too, with accelerated energy during the Quaternary period. The result is that we have but a decimal portion of the original Triassic formation remaining.

During the Quaternary, northern New Jersey, in common with a great area in the northeastern part of the continent, was buried beneath glaciers of great thickness. In Hudson County the ice-sheet moved from north-west to south-east, ploughing out in its journey the soft Triassic shales and sandstones, and grinding off the projecting ridges of trap with a force so irresistable that a mountain-ridge like the Palisade range could not deflect it from its course. When the climate ameliorated and the glaciers retreated northward, the hard crystalline trap was left with a polished surface that glitters in the sun light, and is crossed by deeply engraved lines that faithfully record the direction from which the glaciers came. In places the rock rises into smoothly rounded hillocks, forming typical *roches moutonnées.* The load that the glaciers carried was spread over valleys and uplands, forming a continuous sheet of glacial drift, which now composes the immediate surface of a large portion of the county. This glacial drift is generally a tenacious clayey deposit, at times fifteen or twenty feet thick, of a reddish color, derived from the debris of Triassic shalas and sandstones that enter largly into its composition. Scattered through it are boulders of trap, sandstone, slate, etc., that have been transported but a short distance, and others of gneiss and conglomerate, the parent ledges of which are thirty or forty miles to the northwestward. Hudson county also furnishes examples of modified drift, consisting of irregular layers of sand, gravel and small boulders, all well rounded and plainly assorted and deposited through the agency of running water.

More recent than the glacial deposits are the sand dunes that skirt the base of the upland on all sides. Again more recent than the hills of æolian sand are the many deposits of peat and mud still in process of formation along nearly the whole water-front of the county.

The bed-rock in Hudson county is, in most places, excepting on the uplands, deeply covered by Quarternary and recent deposits. The topography of the rocky floor of the county and of the neighboring portions of New

York, would not only be of great interest to the geologist but of direct economic importance to all interested in shipping, harbor improvements, reclamation of land, etc. The records of deep wells and soundings in the salt marshes that have a bearing on this subject are tabulated in the paper published by the Academy. On the Newark Meadows and in Newark Bay the rock bottom is from two to three hundred feet below the present surface. East of Bergen Hill soundings show a depth to rock nearly as great. The following list taken from the tables mentioned above, give some of the soundings on the borders of the deeply eroded channels of the Hudson, East and Harlem rivers :

Hudson River, foot of 23d st., 250 feet from the east building line of the river street	175 ft. to rock.
Hudson River, foot of Bethune st., 20 ft. W. of bulkhead line	176 ft. rock not reached
Hudson River, pier 60 (old No.), 20 feet W. of bulkhead line	175 ft. to rock
East River, N. Y. Tower of Brooklyn Bridge	107.4 ft. to bed rock
East River, Brooklyn Tower of Brooklyn Bridge	88 " "
East River, pier 41, N. Y, 200 ft. from the building line of South st.	91 " "
East River, pier 18, 200 ft. from the building line of South st	60 " "
Harlem River at High Bridge, centre of river	70 ft. rock not reached
Harlem River, Madison av. Bridge, centre of river	75 " " "
As shown on the Coast Survey Charts of New York harbor, the water in the Hudson off Castle Point is	50–65 ft. deep
In East River, W. of Blackwell's Island	107 " "
In East River, at Hell Gate	121 " "
" " near Ward's Island	170 " "
In New York Harbor	60–80 " "
In the Narrows	60–116 " "
In the Kill Von Kull	25–54 " "
In Arthur's Kill	20–35 " "

These measurements, none of which give the maximum depth of the old channels, clearly prove that the drainage system about New York was at no very distant time several hundred feet below the present water surface. It might be shown with equal certainty that we are living many thousands of feet below what would have been the surface of the county had there been no erosion.

THE SOULS OF PLANTS AND ANIMALS.

By the Rev. Dr. Thomas Hill.

The only things concerning which we can arrive at absolute certainty are space, time and spirit. Their existence and some of their attributes are announced in every act of self-consciousness. Their existence and attributes are not matters of inference, but of direct sight. Matter, on the other hand, can substantiate its existence only by inference from these primal truths of space, time and spirit. All natural sciences are matters of mere deduction from the data furnished by mathematics and mental philosophy. All the business of life, (our manufactures, commerce, history), relating primarily to material things, rests in the same way, ultimately on truths of space, time and spirit; that is on mathematics and philosophy. The conclusions at which we arrive in the historical and natural sciences are therefore more or less probable; and the probability may reach a degree that is practically indistinguishable from certainty. I am practically as sure that this sheet of paper would burn if I held it in the gas jet, as I am that two straight lines cannot enclose a space. Nevertheless the first truth is a matter of contingency and probability, the second of absolute knowledge. These truths of absolute certainty, of direct intuition, concerning space, time and self-conscious mind, are not contingent; they remain true, though heaven and earth pass away, and the perception of them is that which puts the stamp of immortality on the human mind.

But in addition to these fields of direct sight, the three fields of truth outside the conscious mind, are of the highest value. In the first place the certainty of the existence of other minds, is as near absolute certainty as it is possible for a truth of inference to be. That there are other men about me, and there is an Infinite Mind above us all, are truths which are practically as certain as the axioms of geometry. In the second place my fellow men are acting and have been acting, thinking, writing, painting, composing, legislating, warring and making peace, manufacturing and inventing for thousand of years; and the study of their history is the richest and most fruitful method of developing my own powers, and learning to know myself. In the third place the field of space and time in which their history is cast is full of this wondrous matter, which gives them their opportunities, their means, their tools; without it mental or moral life is inconceivable; consciousness itself is awakened to activity only through contact with matter; space and time are visible only through motion as a phenomenon of matter.

Here then is a great object of study, worthy of man's thought. Socrates was fearful lest Plato should spend too much time on questions relating to the measurement of matter; Dr. Johnson in the Rambler carried Socrates's implied censure much farther than the old philosopher himself would have done. Swift in his voyage to Laputa satirizes the students of physical science; the newspapers of our own day indulge occasionally in laughing at the technicalities of the scientific man; even men as wise as the Autocrat of the Breakfast Table utter occasional words of disparagement in speaking of scientific pursuits. But Plato's geometry has done as much for the intellectual and purely spiritual development of our race as Socrates's morality; and the physical philosophers of Europe, during the past three centuries, have, despite their own frequent ignorance of spiritual things, been of immense advantage to spiritual philosophy.

The relations of space are the earliest object of our scientific research. The first really intellectual ideas in a child's mind are those of geometric form. Hence all sciences that flow directly from geometrical relations are likely to be earliest developed. Mechanics preceded chemistry, and the classification of plants and animals by their outward forms preceded the knowledge of physiology, animal or vegetable.

Let us look then a moment at the geometrical study of material things, and see what it involves. Material forms suggest to the child the consideration of shape. He early learns to abstract form from the outward things and compare likeness in form only. He is but a few months old when the smallest drawing of a man, a dog, or cat, is recognized at sight. In a few years he takes the further step of looking by reason beyond the picture of imagination, and seeing the unimaginable realities in space itself. He conceives, for example, a sphere. But that portion of space which lies in a given sphere, surrounding a given point, has no properties by which it is distinguished from other parts of space. This is the Leibnitzian argument by which some modern writers would disprove the existence of space; that its parts are indistinguishable and therefore coincident. But the geometer answers: No! by an act of mind I seize upon any point of space and hold it as the centre of any sphere I wish to consider. When he has thus seized upon and considered a portion of space, bounded and separated from the surrounding space, by an act of his pure intel-